REMARKS

Claims 48-50, 53, 56-58, 60-64, 68 and 69 are pending in the application.

I. Applicant appreciates the courtesy of the Interview with the Examiner conducted on March 28, 2002. In conformity therewith, new claims have been filed. In particular, claim 68 (replacing claim 47) has been worded with process features as discussed in the interview, claims have been worded as use claims with corrected claim 61 as discussed in the interview.

In case it is deemed to be necessary in new claim 68 in line 5 after "hydrophilic groups" the phrase could be added "which organic component forms an azeotrope with water and".

Furthermore, the last feature of claim 68 could be amended by adding the wording "in an initial cleaning step".

II. Teaching of the closest prior art document (WO 96/28535)

According to its claim 1 WO96/28535 teaches a process for cleaning an article comprising the steps of:

1. Contacting the article (s) with a cleaning agent containing, based on the total weight of (a) and (b),

(a) from 0.01 – 80 weight % of water, and

(b) from 99.99 – 20 weight % of an organic solvent having features of:

(i) forming an azeotrope with water, and

(ii) forming a separate phase after azeotropic distillation,

2. Rinsing said article (s) with a rinsing agent containing from 99.99 - 60 weight % of water and from 0.01 – 40 weight % of said organic solvent, based on the total weight of a rinsing agent, whereby the water contained in the rinsing agent is higher than the water content in the cleaning agent.

3. Combining at least a portion of cleaning agent used in step 1 and at least a portion of the rinsing agent used in step 2 and subjecting the combined liquid to an azeotropic distillation, separating the azeotrope into a water-rich phase and a solvent-rich phase, recycling at least a portion of the solvent-rich phase to step 1 and recycling at least a portion of the water-rich phase to step 2.

As stated on page 3, lines 6 – 11, the percentage of water in the cleaning agent may be higher than its solubility in the organic solvent at the given cleaning temperature. In this case the cleaning agent is an emulsion. This means that the cleaning agent is basically the organic solvent with some water dissolved in the organic solvent up to a concentration where the cleaning agent forms an emulsion of water

droplets in a continuous organic phase.

In contrast, the rinsing agent according to page 16, lines 7 to 9, basically consists of water with some organic solvent added to water up to a concentration at which the percentage of the organic solvent in the rinsing agent is higher than its solubility in water; in this case the rinsing agent is an emulsion.

According to the most preferred examples in example 1 the cleaning agent contains about 12% of water in an organic component (propyleneglycol mono n-butyl ether) (page 19, lines 22, 23). The rinsing agent comprises 4.6 weight % of the same organic component in water (page 19, lines 23, 24). The cleaning agent and the rinsing agent of this preferred example are clear liquids and form no emulsions.

Similarly, in example 2 the cleaning agent comprises 1% of water in organic solvent, the rinsing agent comprises 4% organic solvent in water, wherein both agents form clear liquids at the cleaning temperature.

Summary:

WO 96/28535 teaches the cleaning of an article in a liquid cleaning composition consisting almost only of an organic component with molecules having lipophilic and hydrophilic groups and with some water added to the organic component. The cleaning

is followed by a rinsing step with rinsing agent consisting of water with an organic component added to the water, preferably in an amount being completely soluble in water. Cleaning is clearly defined by dissolving dirt sticking to the surface of the article to be cleaned in said liquid cleaning composition. Rinsing is clearly defined by removing residues of said cleaning composition (possibly with some dirt dissolved therein) from the cleaned surface.

The basic teaching of WO 96/28535 thus corresponds to the knowledge of one of ordinary skill in the art, i.e. to clean with an agent consisting mainly of an organic solvent and after the cleaning to rinse with an agent consisting mainly of water and including some organic solvent in a low concentration. The purpose of the rinsing step is to remove the cleaning agent used in the previous cleaning step to a sufficient degree (see page 16, line 37 to page 17, line 4).

There is no hint in WO 96/28535 that it would be advantageous in any respect to use an emulsion instead of a clear cleaning or rinsing agent.

III. Teaching of the present invention (proposed new claims 68 and 69)

In distinct contrast to the teaching of WO 96/28535, the present invention teaches the cleaning of an article, i.e. the removal of dirt sticking to the surface of said article, by providing a liquid cleaning composition which basically (with a high

concentration of water and low concentration of organic solvent) corresponds to the rinsing agent of WO 96/28535 but which contains the organic component in a concentration greater than its solubility in water at the cleaning temperature, so that the liquid cleaning composition forms an emulsion of droplets of the organic phase in a continuous aqueous phase when being agitated at said cleaning temperature. Without agitating (as required by the new claims) the liquid cleaning composition would, at the cleaning temperature, form two separate phases with normally the organic phase (small volume) above the aqueous phase (big volume). Such a two-phase composition would not clean.

There is no hint anywhere in the prior art that such liquid cleaning composition being maintained in a status of an emulsion of droplets of the organic phase in a continuous aqueous phase has an excellent cleaning performance despite its low content of the organic component. This excellent cleaning behavior, which is surprising and unexpected for one skilled in the art, can be seen from appendix 1, which shows graphs representing the cleaning efficiency versus concentration of the organic component in water. The graph with round dots exhibits the cleaning efficiency for SMT Adhesives, i.e. adhesives as used in Surface Mounting Technology with electronic boards, and the graph with rectangular dots exhibits the cleaning efficiency for ionic contamination. As can be clearly seen from appendix 1 of the miscibility gap (limit of the solubility of the organic component in water) the cleaning performance for SMT Adhesives (organic dirt) suddenly steeply increases up to a value near the cleaning

performance of the pure organic component (100% solvent ratio), whereas the cleaning efficiency for inorganic dirt (ionic contaminations) stays high up to 20% solvent ratio, i.e. with the liquid cleaning composition being in the status of an emulsion (cloudy) when being agitated. Therefore, with the inventive method, despite the low concentration of organic component, there is achieved a very good cleaning performance for a very broad scale of contamination. This seems to be achieved by the droplets of the organic composition, which act during the mechanic agitation when contacting the dirt or contamination sticking to the surface of the article to be cleaned as a pure organic component (100%) which dissolves the contamination within the organic droplet, and seem to further act by the mechanical effect of a surface or the mass of the droplet.

IV. Novelty and inventiveness of subject matter of new claims 68 and 69:

As has been pointed out in detail the inventive method is in distinct contrast to the prior art method. The prior art discloses to clean an article (dissolve dirt) with a liquid cleaning composition having a high concentration of an organic component and a low concentration of water, which liquid cleaning composition preferably forms a clear liquid with the water completely dissolved in the organic component. After the cleaning step a rinsing step has to be performed with a rinsing liquid consisting mainly of water with some organic component dissolved in the water so as to preferably form a clear liquid, said rinsing step having the purpose to remove residue of the organic component of the cleaning liquid (perhaps with some dirt dissolved in the organic component) from the

surface of the articles to be cleaned. In contrast, the invention teaches cleaning articles with a cleaning liquid containing a low concentration of an organic component in a high concentration of water, the concentration of organic component being such that it is higher than the solubility of the organic component in water, so that said liquid cleaning composition forms an emulsion of organic droplets in a continuous water phase when being agitated.

Referring to the remarks of the Examiner that there is no difference between cleaning and rinsing, applicant respectfully disagrees with this assessment. Not only the language per se makes a clear difference but also the closest prior art document, namely WO 96/28535, clarifies this difference. To clean an article means to remove dirt, preferably solid dirt, sticking onto the surface of the article by dissolving said dirt in the cleaning liquid. To rinse means to wash out any residues of the cleaning liquid adhering to the surface of the cleaned article, and occasionally including some dirt dissolved in the cleaning liquid, by a rinsing liquid, which leaves no more visible residues at the surface of the cleaned and rinsed article. A big advantage of the invention is not only that it uses only a low concentration of an organic component despite of a very thorough cleaning performance for a broad range of soils, but in addition that normally it necessitates no extra rinsing step with an extra rinsing liquid, since the inventive cleaning liquid is as diluted as a conventional rinsing liquid. There is no hint in the prior art for the very good cleaning behavior of the inventive liquids when being maintained in a status of an emulsion of organic droplets in a continuous aqueous phase by agitating.

V. Referring to the argument of the Examiner that an independent method claim as broad as claim 68 would unduly inhibit a skilled person from performing the invention, the following is stated:

Appendix 2 lists some sources for physical data concerning water miscibility of organic compounds, which are available to any skilled person. As obvious from appendix 3, which is a sample of a typical table as given in any of the documents of appendix 2, there is a column showing the solubility of the organic compound in water (w). A miscibility gap exists for such components, which are characterized in the gap of the solubility in water by δ.

Therefore, there is no problem for one of ordinary skill in the art to perform the invention as characterized in the claims.

VI. Summary:

It is respectfully requested that a patent with the claims as now on file, since the subject-matter of the new claims is novel and non-obvious versus the prior art and gives a clear teaching which can be performed by one of ordinary skill in the art.

In light of the foregoing amendment, Applicant respectfully submits that this

application now stands in condition for allowance. Action to this end is courteously solicited. Should the Examiner have any further comments or suggestions, the undersigned hereby respectfully requests an interview in order to discuss appropriate claim language that will place the application into condition for allowance.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE:

IN THE CLAIMS:

Please cancel claims 47, 51, 52, 54, and 65 - 67, add the following new claims 68 and 69, and amend claims 48 - 50, 53, 56 - 58, 60 - 64 to read as follows:

68. (New) A method of cleaning an article with an active liquid cleaning composition, including the steps of:

a) providing a liquid cleaning composition comprising 65% - 99% by weight water and an organic component, and containing molecules having lipophilic and hydrophilic groups, wherein at a temperature at which cleaning takes place, said organic component is present in said water at a concentration greater than its solubility in said water, wherein at at least one of a different temperature and a different concentration, said organic component is completely soluble in said water so as to form an optically clear liquid;

b) bringing said liquid cleaning composition to a temperature at which cleaning is to take place;

c) agitating said liquid cleaning composition to form an emulsion that is in a status of an emulsion having droplets of an organic phase in a continuous aqueous phase; and

d) bringing said liquid cleaning composition into contact with said article, while continuing to agitate said liquid cleaning composition to maintain said emulsion, so as to clean said article by dissolving dirt sticking to a surface of said article.

48. (Amended twice) A method according to claim [47] 68, wherein said cleaning composition is brought into contact with an article at a cleaning temperature of from 40 to 60° C.

49. (Amended four times) A method according to claim [47] 68, wherein the emulsion is maintained by agitation or by applying ultrasound.

50. (Amended four times) A method according to claim [47] 68, wherein said organic component is such that said liquid cleaning composition has a constant boiling temperature or has a boiling temperature which changes so as to become constant during boiling of said cleaning composition to form an azeotrope, and which furthermore includes the steps of vaporizing said liquid cleaning composition, and of causing vapor from said liquid cleaning composition to condense on said article that is to be cleaned therewith.

53. (Amended) A method according to claim [47] 68, wherein said organic component is completely dissolved in said water at a temperature that is lower than said temperature that prevails during a cleaning process.

69. (New) The use of a liquid cleaning composition to clean an article, wherein said liquid cleaning composition comprises 65-99% by weight water and an organic component, and contains molecules having lipophilic and hydrophilic groups, wherein at a temperature at which cleaning takes place, said organic component is present in said water at a concentration greater than its solubility in said water, whereas at at least one of a different temperature and a different concentration, said organic component is completely soluble in said water so as to form an optically clear liquid, wherein said

liquid cleaning composition is brought to a temperature at which cleaning is to take place, wherein said liquid cleaning composition is agitated to form an emulsion that is in a status of an emulsion having droplets of an organic phase in a continuous aqueous phase, and wherein said liquid cleaning composition is brought into contact with an article that is to be cleaned, while said liquid cleaning composition continues to be agitated to maintain said emulsion, so as to clean said article by dissolving dirt sticking to a surface of said article.

56. (Amended twice) [A] Use of a liquid cleaning composition according to claim [54] 69, wherein said organic component is completely dissolvable [dissolved] in said water at a temperature that is lower than said cleaning temperature.

57. (Amended twice) [A] Use of a liquid cleaning composition according to claim [54] 69, wherein said water is present by at least 75% by weight.

58. (Amended twice) [A] Use of a liquid cleaning composition according to claim [54] 69, wherein said water is present by at least 85% by weight.

60. (Amended) [A] Use of a liquid cleaning composition according to claim [54] 69, wherein said organic component is such that said liquid cleaning composition is an azeotrope.

61. (Amended three times) [A] Use of a liquid cleaning composition according to claim [54] 69, wherein said organic component is a solvent having the general formula:

$$R^1 - [X]_n - R^3$$

where R^1 and R^3 are each independently selected from the group consisting of H, CH_3, C_2H_5, straight-chain or branched, saturated or unsaturated C_3 to C_{18} alkyl groups in

which one or more nonadjacent -CH_2- groups may be replaced by –0-, [imido] -NH- in which the hydrogen may be replaced by C_1 to C_8 alkyl groups, saturated or unsaturated cyclic C_3 to C_6 groups, in which one or more nondajacent –CH_2- groups may be replaced by –0-, [imido] -NH- in which the hydrogen may be replaced by C_1 to C_8 alkyl groups;

X is selected from the group consisting of -0-, -C(= 0)-, -C(= 0)-0-,-NH-, [-NR^4- (where R^4 is selected from the group consisting of H, CH_3, C_2H_6, and straight-chain or branched, saturated or unsaturated C_3 to C_{15} alkyl groups),] -N(OH)-, straight-chain or branched [C_2] C_3 to C_8 alkylene groups in which one or more nonadjacent -CH_2- groups may be replaced by -0-;

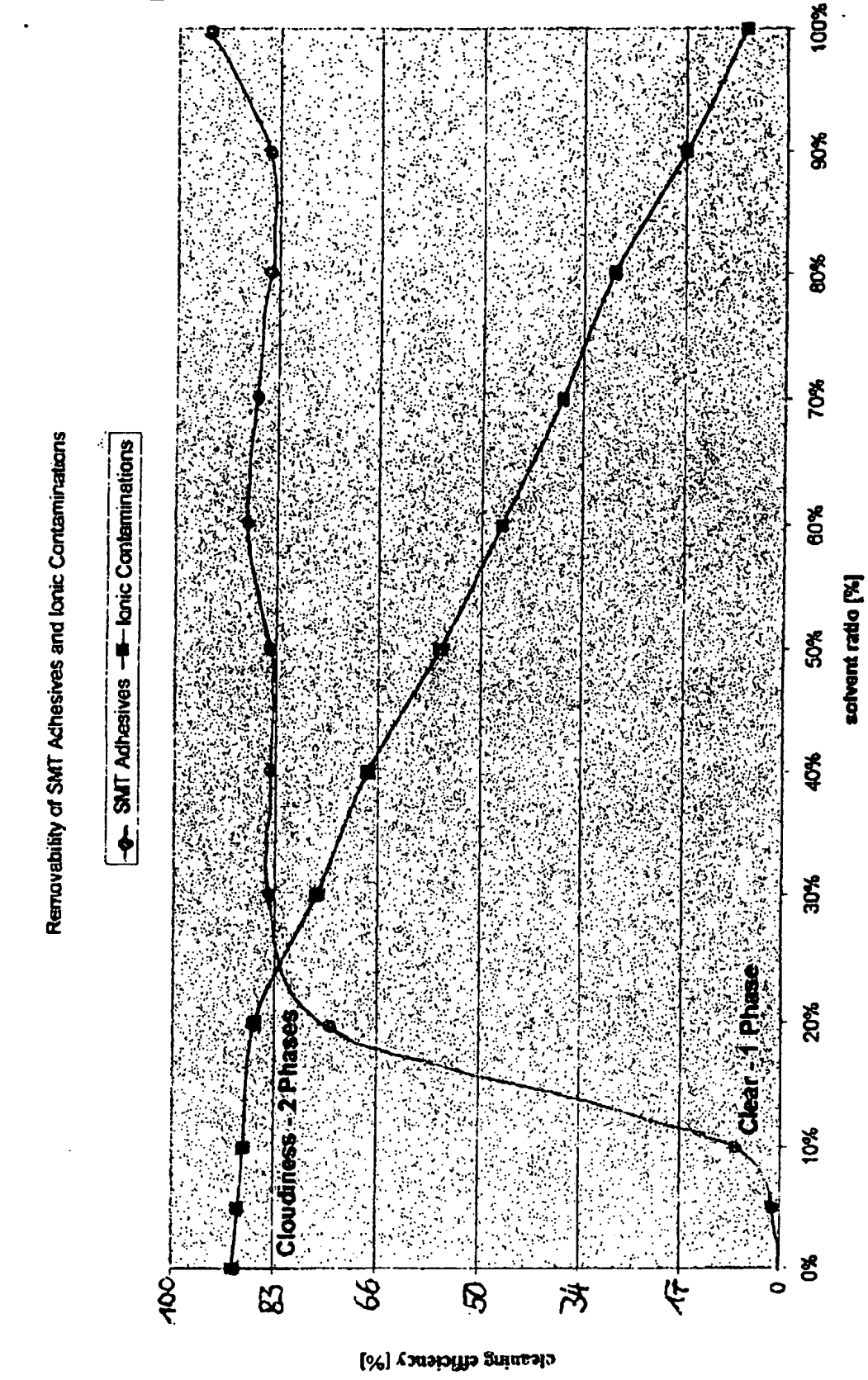
and n represents whole integers.

62. (Amended twice) [A] Use of a liquid cleaning composition according to claim [54] 69, which further includes at least one of the group consisting of a not spontaneously evaporating cleaning reinforcer and a corrosion protection additive [, which are distillable together with the liquid cleaning composition].

63. (Amended three times) [A] Use of a liquid cleaning composition according to claim [54] 69, wherein said organic component comprises glycol ether.

64. (Amended) [A] Use of a liquid cleaning composition according to claim 63, wherein said glycol ether is dipropyleneglycol mono-n-propyl ether.

Appendix 1


CLEANING EFFICIENCY
Removability of SMT Adhesives and Ionic Contaminations
SMT Adhesives
Ionic Contaminations
Cloudiness - 2 Phases
Clear - 1 Phase
cleaning efficiency [%]
100
83
66
50
34
17
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
solvent ratio [%]

Appendix 2

Sources for physical data concerning water miscibility

Handbook of Chemistry and Physics: 54Th Edition 1973-74. Ed. R. C. Weast. published CRC Press, C 75 ff

http://www.hbcpnetbase.com
This 3rd electronic edition follows the 81st edition of the print Handbook (of Chemistry and Physics) in terms of content. There are several updated and expanded tables: Fundamental Physical Constants (the new set of CODATA recommended values, replacing the 1986 set); The Elements (descriptive texts on the occurrence, properties, history, and uses of all the chemical elements); Dissociation Constants of Organic Acids and Bases (expanded by 50%); Dipole Moments (revised and expanded); Threshold Limits for Airborne Contaminants (including the most recent recommendations).

Handbook of Physical Quantities. Grigoriev, Igor S. and Meilikhov, Evgenii Z. eds. Boca Raton: CRC Press, 1997. 1548p. ISBN: 0849328616. This reference provides information concerning the physical phenomena and properties of various media. Presents basic physical parameters and properties of various substances employed in modern science and industry. The material is subdivided into the following branches: mechanics, thermodynamics, transport phenomena, electricity and magnetism, optics and lasers, nuclear physics, astronomy, and geophysics. Numerical data presented in the form of figures and tables are supplemented with short introductory texts giving concise and comprehensive coverage of the subject.

International Critical Tables of Numerical Data, Physics, Chemistry and Technology. US National Research Council. New York: McGraw-Hill, 1926-30. 7v. Separately published index, 1933. Out of Print. This classic was comprehensive at the time of publication. Still contains much useful information although out of print.

Materials and Technology: A Systematic Encyclopedia of the Technology of Materials Used in Industry and Commerce, Including Foodstuffs and Fuels. Codd, L. W. et al, eds. London: Longman, 1968-75. 8v. Comprehensive, if dated. Vol. 1: Air, water, inorganic chemicals and nucleonics. Vol. 2: Non-metallic ores, silicate industries and solid mineral fuels. Vol. 3: Metals and ores. Vol. 4: Petroleum and organic chemicals. Vol. 5: Natural organic materials and related synthetic products. Vol. 6: Wood, paper, textiles, plastics and photographic materials. Vol. 7: Vegetable food products and luxuries. Vol. 8: Edible oils and fats, animal food products. Material resources. General index. Appendix.

CRC HANDBOOK OF TABLES FOR ORGANIC COMPOUND IDENTIFICATION, 3rd ed. Z. Rappoport, Chemical Rubber Co., 1967 SELREF/QD65.C4 suppl 1967 This handbook provides physical constants for many different organic compounds tabulated and organized by chemical groups such as alcohols, ketones, esters, and alkenes. Logarithmic tables, carbohydrate properties and other data are included along with an index for the organic compounds included in the tables. Properties: Physical; Spectral; Thermal; Materials: Organic chemicals Identifiers: Boiling point; Density; Dissociation constant; Freezing point; Infrared correlation; Melting point; Miscibility; Refractive index; Specific rotation

No.	Name	Synonym and Formula	Mol. wt.	Color, crystalline form, specific rotation and λmax (log ε)	m.p. °C	b.p. °C	Density	n_D	Solubility: w	al	eth	ace	ay	other solvents	Ref.s
	Abietic acid														
a1	Abietic acid	Sylvic acid. $C_{19}H_{29}CO_2H$.	302.46	mcl pl (al-w) [α]$_D^{25}$ -116 (al; c = 1) λ^{al} 234 (2.50), 241 (4.57)	173-4	250°			i	s	v	s	v	CS_2, s MeOH s	BS^1, 424
a2	.methyl ester	$C_{21}H_{32}O_2$. *See* a1	316.49			225-6^{10}	1.049^{15}	1.5344	i	s				eas	BS^1, 430
	Aceretin	*See* Flavone, 5,7-Dihydroxy-4'-methoxy-													
a3	Acenaphthenanthrocene	Naphtho-2',3':4,5-acenaphthene.	254.34	pa yel pl (lig) λ^{al} 227 (4.88), 289.5 (3.80), 321 (3.19)	192.5 -3.5				i				s	con sulf, eas s lig^6	B5144, 565
a4	Acenaphthene	Naphthylenethylene.	154.21	nd (al) λ^{al} 227.5 (4.86), 289 (3.80), 320 (3.60), 321 (3.79)	96.2	279^{760}	1.02422^{20} 1.2252	1.6048^{20}	i	s^6			v	eas	BS^1, 495
a5	.1-amino-	$C_{12}H_{11}N$. *See* a4	169.23	cr (peth)	135	sub			s	v		s		mi s, chl s (red sol)	B12^2, 764
a6	.3-amino-	$C_{12}H_{11}N$. *See* a4	169.23	pl (al), nd (peth) pk in air	81.5					s				con lig^6	P13, 148
a7	.4-amino-	$C_{12}H_{11}N$. *See* a4	169.23	nd (al, w)	87				s^1			s			B12^2, 764
a8	.5-amino-	$C_{12}H_{11}N$. *See* a4	169.23	nd (lig) red in air	108					s					B13, 149
a9	—,5-bromo-	$C_{12}H_9Br$. *See* a4	233.12	pl (al) λ^{al} 250 (3.3), 290 (4.1), 300 (4.2), 313 (4.0)	52	335^{760}	1.4392^{t}	1.6565^{16}	i	s					BS^1, 276
a10	.5-chloro-	$C_{12}H_9Cl$. *See* a4	188.66	pl or nd (al)	70.5	319.2^{760} 163^{13}	1.1954^{0}	1.6288^{1}	i	s^6					BS^1, 276
a11	.5-iodo-	$C_{12}H_9I$. *See* a4	280.11	nd (al)	65		1.6738^{15}	1.6909^{15}	i	s			s	eas	B13, 145
a12	.5-nitro-	$C_{12}H_9NO_2$. *See* a4	199.21	gr-ye nd (aa)	151.5				i					sulfs (re-bl—, red) con alk s (red) eas^6	B13, 147
	—,1-oxo-	*See* 1-Acenaphthenone													
a13	5-Acenaphthenecarboxylic acid	5-Acenaphthoic acid.	198.22	nd (hy or lig) λ^{al} 236.5 (4.45), 311 (3.9)	220-1								d^6	lig^6	B9^1, 280
a14	Acenaphthenequinone	Acenaphthaquinone.	182.18	ye nd (aa) λ^{al} 223 (4.45), 327 (3.86), 338 (3.86)	261				i	s			s^6	lig^6, eo A, s^6	B13, 169
a15	3-Acenaphthenesulfonic acid		234.28	hyg nd (ba)	87-9				s						B13, 181
a16	1-Acenaphthenone	1-Oxoacenaphthene.	168.21	nd (al)	121				s^6	s^6			v	chl s, sulf (ye-gr) NaOH s (vi)	B13, 166
a17	Acenaphthylene		152.21	pr (eth), pl (al) λ^{al} 276 (3.65), 311 (3.88), 323 (3.98), 339 (3.66), 340 (3.67)	92-3	265-75 part d 156-60^{20}	0.8988^{0}			v	v		v		BS^1, 930
a18	Acetaldehyde	Acetic aldehyde. Ethanal^6. CH_3CHO	44.05	λ^{vap} 290 (1.23), λ^{vap} 178 (3.48), 181 (3.60), 181.5 (4.05)	-121	20.8^{760}	0.7834^{0}	1.3316^{15},	∞^{1}	∞	∞	...	∞		B1^3, 2817
a19	.bis(2-chloroethyl) acetal	1,1-Bis(2-chloroethoxy)-ethane^6. $CH_3CH(OCH_2CH_2Cl)_2$	187.07			194 ad 106-7^{15}	1.1737^{0}	1.4526^{15}	d^6	s^6	s^6				B1^3, 2644
a20	—,diacetate	Ethylidene diacetate. $CH_3CH(O_2CCH_3)_2$	146.14		18.9	169^{760} 85-7^{15}	1.3985^{15}	1.070^{15}		s	s				B3^1, 187
a21	—,diethyl acetal	Acetal. 1,1-Diethoxyethane^6. Ethylidene diethyl ether. $CH_3CH(OC_2H_5)_2$	118.18	volat λ^{vap} 270 (0.9)		103.2^{760} 21^{23}	0.8314^{0}	1.3834^{20}	s	∞	∞	∞	v	chl s	B1^3, 2661
a22	—,dimethyl acetal	1,1-Dimethoxyethane^6. Ethylidene dimethyl ether. $CH_3CH(OCH_3)_2$	90.12		-113.2	64.5	0.8301^{25}	1.3668^{20}	s	s	s	v		chl s	B1^3, 671
a23	—,2,4-dinitrophenylhydrazone (stable form)		224.19	ye cr (al) λ^{al} 355 (4.3)	168.5 (164)				i	s^6	s^6	s	v	chl v	B15^1, 490
a24	—,—(unstable form)	$C_8H_8N_4O_4$. *See* a23	224.19	org-red	146 (137)				i	s	s	s			B15^1, 490
a25	—,oxime	Acetaldoxime. $CH_3CH{=}NOH$	59.07	nd λ^{al} < 220	47	115^{760}	0.9636^{0}	1.4256^{17}	s^6	∞	∞				B1^3, 675
a26	—,phenylhydrazone	*N*-Ethylidene-*N'*-phenylhydrazine $CH_3CH{=}NNHC_6H_5$	134.18	(i) nd or lf (ii) nd λ^{al} 268 (4.25)	(i) 98 (ii) 101 (iii) 57	133-6^{15}				s				lig^6	R19^1, 56

For explanations, symbols and abbreviations see beginning of table. For structural formulas see end of table.

Appendix 3
page 1

[α]	specific rotation
δ	slightly
>	above, more than
<	below, less than
∞	soluble in all proportions
•	name approved by the International Union of Chemists (I.U.C.)[1]
Ω	IR, or UV, or NMR spectra referenced
?	unknown
aa	acetic acid
abs	absolute
ac	acid
Ac	acetyl
ace	acetone
al	alcohol[2]
alk	alkali
Am	J. Am. Chem. Soc.
Am	amyl (pentyl)
amor	amorphous
anh	anhydrous
aqu	aqueous
as	asymmetric
atm	atmospheres
b	boiling
B	Beilstein
Ber	Chem. Ber.
bipyra	bipyramidal
bk	black[3]
bl	blue[3]
br	brown[3]
bt	bright
Bu	butyl
bz	Benzene
C	Chem. Abs.
c	percentage concentration
ca	about (circa)
chl	chloroform
co	columns
col	colorless
con	concentrated
cor	corrected
cr	crystals
cy	cyclohexane
d	decomposes
D	line in the spectrum of sodium (subscript)
D, d	dextro[4]
dd	slight decomposition
dil	diluted
diox	dioxane
distb	distillable
dk	dark
Dl, dl	racemic[4]
dlq	deliquescent
DMF	dimethyl formamide
E	Elsevier's
eff	effloresces
Et	ethyl
eth	ether[5]
exp	explodes
extrap	extrapolated
fl	flakes
flr	fluorescent
fr	freezes
fr. p.	freezing point
fum	fuming
gel	gelatinous
gl	glacial
gold	golden
gr	green[3]
gran	granular
gy	gray[3]
h	hot
H	Helv. Chim. Acta
hex	hexagonal
hp	heptane
hting	heating
hx	hexane
hyd	hydrate
hyg	hygroscopic
i	insoluble
i-	iso-
ign	ignites
in	inactive
inflam	inflammable
infus	infusible
irid	iridescent
iso	isooctane
J	J. Chem. Soc.
JOC	J. Org. Chem.
l-, l	levo[4]
la	large
lf	leaf
lig	ligroin
liq	liquid
lo	long
lt	light
m	melting
m-	meta-
M	molar (concentration)
M	Merck Index, 7th Edition
mcl	monoclinic
Me	methyl
met	metallic
micr	microscopic
min	mineral
mod	modification
mut	mutarotatory
n	normal chain, refractive index
N	normal (concentration)
N	nitrogen[6]
nd	needles
o-	ortho-
oct	octahedral
og	orange[3]
oos	ordinary organic solvents
or	or
ord	ordinary
org	organic
orh	orthorhombic
os	organic solvents
p-	para-
pa	pale
par	partial
peth	petroleum ether
pk	pink[3]
Ph	phenyl
pl	plates
pr	prisms
Pr	propyl
Prak	J. Prak. Chem.
purp	purple[3]
pw	powder
Py	pyrimidine
pym	pyramids
rac	racemic
rect	rectangular
red	red
res	resinous
rh	rhombic
rhd	rhombohedral
s	soluble
s	secondary[7]
sc	scales
sec	secondary[7]
sf	softens
sh	shrinks
silv	silvery
sl	slightly (δ)
so	solid
sol	solution
solv	solvent
sph	spheroidal
st	stable
sub	sublimes
suc	supercooled
sulf	sulfuric acid
sym	symmetrical
syr	syrup
t	tertiary[7]
ta	tablets
tcl	triclinic
tert	tertiary[7]
Tet	Tetrahedron
ter	tetragonal
THF	tetrahydrofuran
to	toluene
tr	transparent
trg	trigonal
undil	undiluted
uns	unsymmetrical
unst	unstable
v	very
vac	vacuum
var	variable
vap	vapor
vic	vicinal
visc	viscous
volat	volatile or volatilizes
vl	violet[3]
w	water
wh	white[3]
wr	warm
wx	waxy
ye	yellow[3]
xyl	xylene

1 For I.U.C. rules of nomenclature see General Index.
2 Generally means ethyl alcohol.
3 The abbreviation of a color ending in "sh" is to be read as ending with the suffix "-ish," *e.g.*, grsh means greenish.
4 *D, L* generally mean configuration and *d, l* generally mean optical rotation, but there are many examples in the chemical literature for which the meaning of these symbols is ambiguous and/or interchangeable.
5 Generally means diethyl ether.
6 *N* indicates a position in the molecule.
7 *s* and *sec*, or *t* and *tert*, are used as convenient.

Appendix 3
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